Chromospheric LAyer Spectro-Polarimeter: CLASP Re-flight proposal

Completed Technology Project (2017 - 2019)

Project Introduction

A major remaining challenge for heliophysics is to decipher the magnetic structure of the chromosphere, advocated as a high priority Science Goal in the Heliophysics Roadmap due to its "large role in defining how energy is transported into the corona and solar wind." Routine satellite measurements of the chromospheric magnetic field will allow our understanding of the chromosphere and its connection to the rest of the solar atmosphere to improve dramatically. Before such a satellite can be considered for flight, it is important to refine the measurement techniques by exploring candidate emission lines with a range of magnetic sensitivities. In September 2015, CLASP achieved the first measurement of the linear polarization produced by scattering processes in a far UV resonance line (hydrogen Lyman-alpha), and the first exploration of the magnetic field via the Hanle effect in quiet regions of the chromosphere-corona transition region. These measurements are a vital first step towards routine quantitative characterization of the local thermal and magnetic conditions in this key layer of the solar atmosphere. Nonetheless, Lyman-alpha is only one of the magnetically sensitive spectral lines in the UV spectrum; the Mg II h and k spectral lines near 280 nm, whose cores form about 100 km below the Lyman-alpha core, are also a compelling target. This is because they are sensitive to a larger range of field strengths than Lyman-alpha, through both the Hanle and Zeeman effects. Studying the polarization of the Mg II resonance lines is also particularly timely since their intensity spectrum has been extensively studied over the past few years with IRIS and via advanced numerical models. We therefore propose the Chromospheric LAyer Spectro-Polarimeter 2 (CLASP2). We will refit the existing CLASP instrument to measure all four Stokes parameters in the 280 nm range to study wavelength-dependent variations in polarization caused by the joint action of scattering processes and the Hanle and Zeeman effects. An international team of scientists from Marshall Space Flight Center, National Astronomical Observatory of Japan, Japan Aerospace Exploration Agency, Instituto de Astrofisica de Canarias, Institut d'Astrophysique Spatiale, Istituto Ricerche Solari Locarno, Astronomical Institute of the Czech Academy of Sciences, Lockheed Martin Solar and Astrophysics Laboratory, the High Altitude Observatory, the University of Oslo, and Stockholm University will participate in this new study. The cost associated with this rocket proposal is kept to a minimum as we will reuse many of the components from the first flight. Both CLASP1 and 2 serve as pathfinders for potential satellite missions to measure the magnetic field in the upper chromosphere and transition region of the Sun, by extending spectro-polarimetric measurements to UV lines with a range of magnetic sensitivities relevant for field strengths found in this layer of the solar atmosphere.

Anticipated Benefits

Support NASA’s strategic objectives to understand the Sun and its interactions with Earth and the solar system, including space weather. This will be

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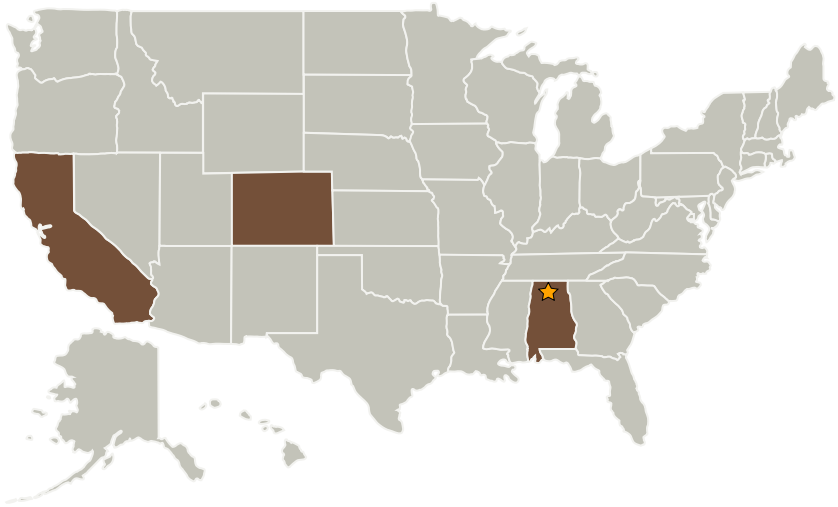
achieved by developing/demonstrating instrumentation technology necessary to address the following science goals:

- Explore the physical processes in the space environment from the Sun to the Earth and throughout the solar system;
- Advance our understanding of the connections that link the Sun, the Earth, planetary space environments, and the outer reaches of our solar system;
- Develop the knowledge and capability to detect and predict extreme conditions in space to protect life and society and to safeguard human and robotic explorers beyond Earth.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	California
Colorado	

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Heliophysics Technology and Instrument Development for Science

Project Management

Program Director:

Roshanak Hakimzadeh

Program Manager:

Roshanak Hakimzadeh

Principal Investigator:

David E Mckenzie

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Project Management *(cont.)*

Co-Investigators:

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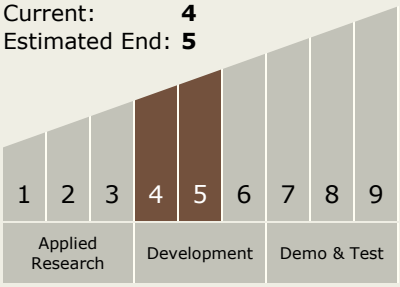
Taro Sakao
Jiri Stepan
Christian Bethge
Bart W De Pontieu
Masahito Kubo
Tanausu Del Pino Aleman
Luca Belluzzi

Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **5**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.3 Optical Components

Target Destination

The Sun